<u>WHAT IS CLAIMED IS:</u>

Please amend the claims as follows:

1. (Currently Amended) A numerical calculation method for a physical quantity U practiced on a computer by solving $A \cdot U = f$, wherein A is a coefficient matrix (in N rows by N columns; wherein N is a positive integer) obtained through discrete of a partial differential equation to be satisfied by said physical quantity U, and f is an inhomogeneous term (source term), comprising the processes of:

setting an initial value $U^0$ of said physical quantity U;

setting 0 as an initial value of a number m of repeating times, giving 0 as an initial value of a perturbation quantity $\phi$ and setting $(f - A.U^0)$ as an initial value $r^0$ of a residual r; and

repeatedly executing a first step and a second step while incrementing said number m of repeating times until an approximate solution $U^m$ is converged,

wherein said first step includes the steps of:

obtaining a predicted approximate value $\psi^m$ of $A \cdot \phi = r^m$ through repeated calculation performed by a first calculation unit including an internal solver, and

said second step includes the steps of:

obtaining, from said predicted approximate value $\psi^m$, a corrected approximate value $\phi^m$ for minimizing $L^2$ norm of a residual $\cancel{r^m}$ $\underline{r^{m+1}}$ through an optimization routine performed by a second calculation unit; and

giving $(U^m + \phi^m)$ as an approximate solution $U^{m+1}$ and giving $(r^m - A \cdot \phi^m)$ as a residual $r^{m+1}$,

wherein in said second step, obtained elements of a vector sequence $A \cdot \phi^m$ are sampled by a given sampling method to be stored in a memory, and

a residual minimization coefficient $\alpha_l^m$ (wherein $l = 1, \ldots, L$) used for obtaining said corrected approximate value $\phi^m$ is approximately obtained by

using elements of a vector sequence $A \cdot \phi^k$ (wherein $k = m - L + 1, \ldots, m - 1$) stored in said memory.

2. (Original) The numerical calculation method of Claim 1,

wherein in sampling of elements $b_1, b_2, \ldots$ and $b_N$ of said vector sequence $A \cdot \phi^m$ performed in said second step, elements $b_i$ (wherein $i \in \Omega$) are selected, whereas a subset $\Omega$ is defined as follows:

$$\Omega = \{i : \mathrm{mod}\,[i, lg] = 1\} \cup \{i : |f_i/a_{ii}| > \beta\}$$

wherein lg is an integer, $\beta$ is a real number, $f_i$ is an element of said source term and $a_{ii}$ is a diagonal term on the ith row in the ith column of said matrix A.

3. (Currently Amended) A numerical calculator for a physical quantity U by solving $A \cdot U = f$, wherein A is a coefficient matrix (in N rows by N columns; wherein N is a positive integer) obtained through discrete of a partial differential equation to be satisfied by said physical quantity U, and f is an inhomogeneous term (source term), performing the processes of:

setting an initial value $U^0$ of said physical quantity U;

setting 0 as an initial value of a number m of repeating times, giving 0 as an initial value of a perturbation quantity $\phi$ and setting $(f - A.U^0)$ as an initial value $r^0$ of a residual r; and

repeatedly executing a first step and a second step while incrementing said number m of repeating times until an approximate solution $U^m$ is converged,

wherein said first step includes the steps of:

obtaining a predicted approximate value $\psi^m$ of $A \cdot \phi = r^m$ through repeated calculation performed by a first calculation unit including an internal solver, and

said second step includes the steps of:

obtaining, from said predicted approximate value $\psi^m$, a corrected approximate value $\phi^m$ for minimizing $L^2$ norm of a residual $\cancel{r^m}$ $\underline{r^{m+1}}$ through an optimization routine performed by a second calculation unit; and

giving $(U^m + \phi^m)$ as an approximate solution $U^{m+1}$ and giving $(r^m - A \cdot \phi^m)$ as a residual $r^{m+1}$,

wherein in said second step, obtained elements of a vector sequence $A\cdot\phi^m$ are sampled by a given sampling method to be stored in a memory, and

a residual minimization coefficient $\alpha_l^m$ (wherein $l = 1, \ldots, L$) used for obtaining said corrected approximate value $\phi^m$ is approximately obtained by using elements of a vector sequence $A\cdot\phi^k$ (wherein $k = m - L + 1, \ldots, m - 1$) stored in said memory.

4. (Original) The numerical calculator of Claim 3,

wherein in sampling of elements $b_1, b_2, \ldots$ and $b_N$ of said vector sequence $A\cdot\phi^m$ performed in said second step, elements $b_i$ (wherein $i \in \Omega$) are selected, whereas a subset $\Omega$ is defined as follows:

$$\Omega = \{i : \mathrm{mod}\,[i, lg] = 1\} \cup \{i : |f_i/a_{ii}| > \beta\}$$

wherein lg is an integer, $\beta$ is a real number, $f_i$ is an element of said source term and $a_{ii}$ is a diagonal term on the ith row in the ith column of said matrix A.

5. (Currently Amended) A recording medium that stores a numerical calculation program for a physical quantity U by allowing a computer to solve $A\cdot U = f$, wherein A is a coefficient matrix (in N rows by N columns; wherein N is a positive integer) obtained through discrete of a partial differential equation to be satisfied by said physical quantity U, and f is an inhomogeneous term (source term),

wherein said numerical calculation program makes said computer to execute the processes of:

setting an initial value $U^0$ of said physical quantity U;

setting 0 as an initial value of a number m of repeating times, giving 0 as an initial value of a perturbation quantity $\phi$ and setting $(f - A.U^0)$ as an initial value $r^0$ of a residual r; and

repeatedly executing a first step and a second step while incrementing said number m of repeating times until an approximate solution $U^m$ is converged,

wherein said first step includes the steps of:

obtaining a predicted approximate value $\psi^m$ of $A \cdot \phi = r^m$ through repeated calculation performed by a first calculation unit including an internal solver, and

said second step includes the steps of:

obtaining, from said predicted approximate value $\psi^m$, a corrected approximate value $\phi^m$ for minimizing $L^2$ norm of a residual $\cancel{r^m}$ $\underline{r^{m+1}}$ through an optimization routine performed by a second calculation unit; and

giving $(U^m + \phi^m)$ as an approximate solution $U^{m+1}$ and giving $(r^m - A \cdot \phi^m)$ as a residual $r^{m+1}$,

wherein in said second step, obtained elements of a vector sequence $A \cdot \phi^m$ are sampled by a given sampling method to be stored in a memory, and

a residual minimization coefficient $\alpha_l^m$ (wherein $l = 1, \ldots, L$) used for obtaining said corrected approximate value $\phi^m$ is approximately obtained by using elements of a vector sequence $A \cdot \phi^k$ (wherein $k = m - L + 1, \ldots, m - 1$) stored in said memory.

6. (Original) The recording medium of Claim 5,

wherein in sampling of elements $b_1, b_2, \ldots$ and $b_N$ of said vector sequence $A \cdot \phi^m$ performed in said second step, elements $b_i$ (wherein $i \in \Omega$) are selected, whereas a subset $\Omega$ is defined as follows:

$$\Omega = \{i : \mathrm{mod}\,[i, lg] = 1\} \cup \{i : |f_i/a_{ii}| > \beta\}$$

wherein $lg$ is an integer, $\beta$ is a real number, $f_i$ is an element of said source term and $a_{ii}$ is a diagonal term on the ith row in the ith column of said matrix A.